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be sure that its application to the groups of wealth owners mentioned above does not lead to objections that are more apparent than real.

Regarding Mr. Galton's criticism, that the measure of the distribution of wealth proposed by me employs three independent variables, the reply may be made that the distribution of wealth has these three aspects: —

1. All individuals of the population do not own wealth. Less than half of the people possess wealth in sufficient quantities to be worth an account, and the proportion of the owners ought to be represented to measure what I have termed the width of distribution.

2. Another measure is wanted to determine the inequality of the distribution of wealth, not among all the people, but among its owners. An index can be computed that is a compound of width and of inequality, but it seems to me to be undesirable.

3. The generosity of distribution calls for a third measure. There may be no substantial difference between two communities in respect to the width and the inequality of distribution, but one community may have much more wealth than the other. The average, or Mr. Galton's E, affords this measure.

George K. Holmes.

REGISTRATION REPORT OF MASSACHUSETTS.

Fiftieth Report of Births, Marriages, and Deaths in the Commonwealth, and returns of Deaths investigated by the Medical Examiners, for the Year 1891. Pp. 145. Boston, 1892.

To those who are familiar with the precise and elaborate registration reports of Massachusetts, the report of 1891 will be a surprise and a great disappointment. We are at a loss to account for the change from a compilation which has been universally accepted by statisticians as a model of tabulation and presentation to the present inadequate number.

The reports of previous years were compiled for the use of statisticians as well as for the general public. This, as the editor says, is no longer the case. A student of social science must either go without data hitherto furnished or else laboriously work them out for himself. The principle upon which the work is compiled is expressed on page 113, as follows: "It is not intended, however, in this report to present all the elaborate tables heretofore presented where data are arrived at by an unending series of sums in long division, and by permutations and combinations of figures, which data are, if to anyone, of value only to the statistician who might well himself devote the time and labor necessary to ascertaining the facts desired." This paragraph clearly indicates that the compiler has little sympathy for statisticians, and chooses to ignore their usefulness. He forgets that by working out these data himself, with all the necessary figures at hand, one man may do the work which perhaps otherwise scores of statisticians will have to do individually, and with much greater labor. To a limited extent he works out these data for the "average reader" in a portion of the report entitled "editorial observations." Here he puts together various facts derived from data in the files of statistics kept at the office of the Secretary of State, and these facts he puts down in words, in one or more paragraphs, instead of in figures, as heretofore. For example, on page 115, he makes the statement that the excess of living births over deaths is greater than the excess in any year since the beginning of registration. This fact should be contained also in a table, which at the same time would contain many other facts not mentioned in any paragraph of the report, such, for instance, as the rate of increase of this excess, its relation to the entire population, etc.

Such a method may do for the "average reader," but in a branch of social science, such as vital statistics, the "average reader" is scarcely concerned. Only a small portion of the population ever read the registration report, if, indeed, they know of its existence. As for those who do read it, it may be asserted that they have more use for the tables, which represent so many and such diverse ideas, than they can have for a worded paragraph which represents but one idea of one man. Different people see the same thing in different lights, and thus it may come to pass that one table of statistics can represent a variety of ideas which could be brought out by different people, and all of which would not be conceived by an ordinary compiler of statistics.

Another deviation from regular statistical methods of presentation is shown by the following paragraph from page 113: "It has been thought wise not to attempt to draw inferences, or make ratios and percentages from uncertain data, such, for instance, as an "estimated" population. Such an "estimate" must of necessity be inaccurate as a basis of figuring decimal percentages, and the results obtained are of no more actual value than percentages calculated on the previously ascertained population, as shown by state or national census." This is entirely contradictory to the opinions of the most experienced and ingenious statisticians of England and the United States, and the subject has been investigated and described with the greatest care and thoroughness. The importance of rates based upon "estimated" populations is sufficient to warrant their acceptance by statisticians in all countries, and they form a common basis for the comparison of the social status of nations. The editor criticizes estimates of population by showing that such estimates, made in different years, are not the same, and he gives in illustration the comparison of the estimates of population for 1887 in the 1889 report and in the 1890 report. These estimates are 2,058,647 and 2,060,861, respectively, and the corresponding death rates are 19.80 and 19.78. The difference in the estimates of population amounts to about one-tenth of one per cent, and the difference in death rates to about one death in 50,000 persons. According to his method of computing the death rate for 1887, the difference in rates would be 1.21 per 1000, or 60 times greater than the difference which he criticizes. Such criticism is far-fetched. Indeed, the next refinement would be the abolition of all rates, because no census, whether state or national, can be absolutely correct. Rates based upon one stated census for a period of years would be worse than useless, for they *must* be invariably false, since the population for different years is never the same.

In all countries it is generally admitted that the population may be supposed to increase during a certain time at the same rate, as it did during the preceding intercensal period, although this of course cannot be strictly estimated where there is a moving population due to migration. Estimates are approximate, however, and serve to show the general increase of population with sufficient accuracy for comparison. Thus, in the Registration report of England for 1890, the Registrar furnishes the following table, in order to show the small divergence between death rates per 1000, derived from estimates of population based upon the preceding intercensal rate of increase and those derived by regular increase of the population, as shown by a later census: —

1. Year.	2. Rates Based upon Population Estimated from Intercensal Period 1871-81.	3. Rates Based on Increase, as shown by the Census of 1891.	4. Difference between the Rates in Columns 2 and 3.
1881	18.88	18.89	0.01
1882	19.56	19.62	0.06
1883	19.54	19.64	0.10
1884	19.51	19.66	0.15
1885	19.01	19.21	0.20
1886	19.28	19.52	0.24
1887	18.79	19.07	0.28
1888	17.80	18.11	0.31
1889	17.87	18.22	0.35
1890	19.12	19.55	0.43

From this table it is seen that the differences between original estimates and those based upon a later census are in no case greater than .35 per 1000 (the rate for 1890 is based in the report for that year upon the census of 1891), or about one death in 3000 persons, and such a difference may, for all practical purposes, be disregarded.

Now, while statisticians of all countries are agreed that estimates based upon rates of increase during the last intercensal period are legitimate, there is a variety of methods employed to get these rates of increase.

In a country where births exceed the deaths the population should increase by regular geometrical ratio, like compound interest; but in a country where the population is constantly changing by migration this rate is not accurate; for this reason it has been the custom to assume that the rate of increase during intercensal years has remained the same as that of the last preceding intercensal period. Some statisticians call this annual increase the nth part of the entire increase in population during the period of n years. Thus, if the increase in population of Massachusetts for 5 years is 500,000, the yearly increase, according to this method, would be 100,000. Such a method, however, is not so exact as to consider the increment of population an increasing quantity during the intercensal years. Calling r the annual increase per unit of population, we should have at the end of one year $1 + r$, and at the end of the second year the increase would be denoted by $(1 + r)^2$, and at the end of five years the increase would be denoted by $(1+r)^5$. The annual rate therefore derived from the increase in five years is the 5th root and not the 5th part of the quinquennial rate of increase. This can be expressed as follows: let P denote the population at any time, and P^1 the population at any previous time, and n the number of years between P and P^1, then $\sqrt[n]{\frac{P}{P^1}} = r$, 1 + annual rate of increase.

Of these methods the latter is used most extensively where careful estimates are required, and is usually employed in England for the estimation of the population during the intercensal years. In Massachusetts, on the other hand, the former method has been used of late years, and the report of 1890 contains a table of the estimated population during intercensal years between 1845 and 1890. For a few years (1881 to 1885) the population was estimated in the reports for those years by the numbers of assessed polls; the figures, however, derived in this way, are not so trustworthy as by either of the above methods. The following table shows the difference in these two methods for the 10 years 1880–90: —

	Arithmetical Estimate.	Geometrical Estimate.	Difference.
1880*	1,783,085	1,783,085	......
1881	1,814,896	1,813,820	1,076
1882	1,846,707	1,845,084	1,623
1883	1,878,518	1,876,887	1,631
1884	1,910,329	1,909,237	1,092
1885*	1,942,141	1,942,141	......
1886	2,001,501	1,998,174	3,337
1887	2,060,861	2,055,191	5,670
1888	2,120,221	2,115,131	5,090
1889	2,179,582	2,176,150	3,432
1890*	2,238,943	2,238,943	......

* Census year.

These differences would affect but little the computations of rates, etc. It is better, however, to indicate the more approximate population. Death rates based upon arithmetical estimates are a little too low.

According to the geometrical formula given above, and assuming that the rate of increase of population of Massachusetts is the same as it was during the period 1885 to 1890, we find the population of 1891 equal to 2,303,537. Having given the number of deaths 45,185, we find the death rate is 19.61, instead of 20.18, per 1000 of the living population. The birth rate, too, should be 27.35 instead of 28.15, and the excess of births over deaths should be 7.74 instead of 7.97. The marriage rate should be 9.41 instead of 9.68.

Compared with the estimated population, the death rate from scarletina should be 1.068 per 10,000 instead of 1.097, and this rate is smaller than any previous rate, except for the years 1889 and 1890. The mortality from typhoid fever should be 3.5 per 10,000 of the entire population instead of 3.7, and this rate is less than that for any year for the last 30 years. The mortality from cholera infantum is 12.02 per 10,000 instead of 12.3. The rate for deaths from diseases of the kidneys should be 6.5 per 10,000 instead 6.4. This error is due to careless computation by the editor, and according to his method it should be 6.6.

Throughout the report the editor makes the mistake of comparing the rates for 1891, based upon the census of 1890, with those of previous years, which are based upon estimated populations. To be consistent he should have worked out these rates according to the population as given in the different census years.

The estimated population for 1891 accordingly makes erroneous certain statements in the registration report. For example, the marriage rate is greater than that for any year since 1887 instead of 1883. The death rate is higher than that for any preceding year since 1888 instead of 1875. One person was married to every 52.17 of the population instead of every 51.6. The statement is made that there were more deaths under one year in 1891 than in any other year since the beginning of registration. This conveys an erroneous idea, for we should compare by rates rather than by absolute figures. The rates for deaths under one year for 1891 was greater than that for any year since 1874.

On page 119 of the Report the number of widowers who married maids in 1891 should be 1829 instead of 1827, according to the tables on page 25, and the number of widowers married should be 2778 instead of 2841; and, according to these same tables, the number of widows married in 1891 should be 1890 instead of 1940.

Still further inaccuracies might be noted; for example, the death rate according to the population of 1890 is given as 20.18 per 1000, on page 115, and 20.13 on page 122. Also, 1891 on page 128 should be 1890. On page 122 there is a gross error in proof-reading, the decimal point being misplaced in twelve cases. But these are minor errors, and might occur in the best of reports.

These few facts are sufficient to show the inadequacy of the registration report. A few tables are probably accurate, but the numerous errors throughout the volume necessarily make one sceptical in the use of even these. As a means of showing the position of Massachusetts in 1891, relative to that of previous years, the report is almost worthless, and equally so for comparisons with the social conditions of other states and countries. It is much to be regretted that the report of 1891, in the series of valuable and instructive registration records of Massachusetts, can be used with so little confidence.

G. N. CALKINS.

THE NECESSITY OF A REVISION OF THE CLASSIFICATION AND NOMENCLATURE EMPLOYED IN THE VITAL STATISTICS OF MASSACHUSETTS.

BY S. W. ABBOTT, M.D.

Part of a Paper read before the Massachusetts Medical Society, June 8, 1892.

In the following paper I do not propose to treat exhaustively of the subjects of the medical nomenclature and classification of diseases, but rather to introduce the subject in a suggestive manner with the view of asking the question whether any changes are necessary, and if so what changes, in the classification and nomenclature now employed in the registration of deaths in this state.

What are the primary objects of the classification and nomenclature of diseases? An English writer has clearly said, "a good classification aids and simplifies the registration of diseases, helps toward a more easy comparison and knowledge of them, and toward the storing of experience respecting them, and facilitates the discovering of general principles from the collected, grouped and compared phenomena."[1]

In addition, medical nomenclature and terminology furnish the means for separating and distinguishing diseases and causes of death. Thorough registration must depend to a considerable degree for its efficiency upon the perfection of these means. The classification of diseases or causes of death differs little, if any, in its objects, from

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[1] Elements of vital statistics. Arthur Newsholme, M.D., London, 1889.